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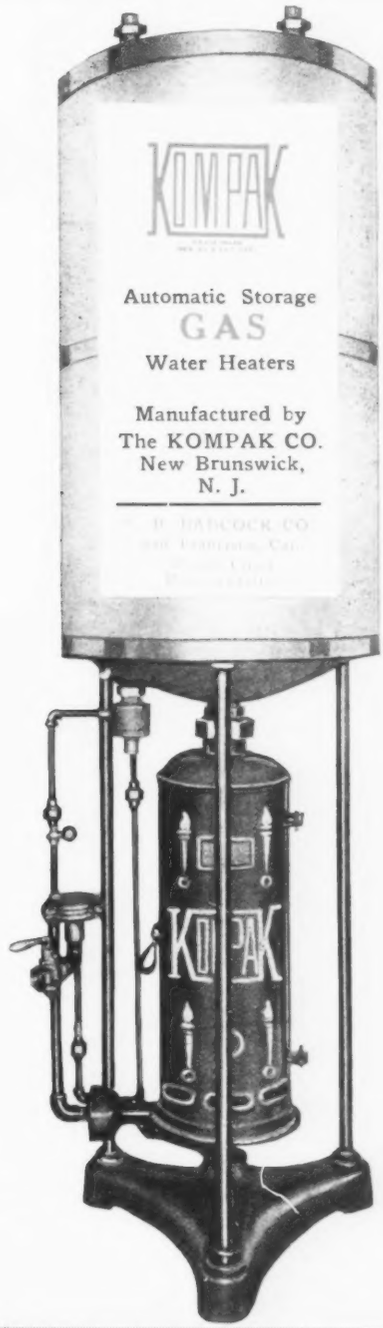

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THE KOPPERS COMPANY

PITTSBURGH, PA.

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Use of Gas in Making Casein, Celluloid Adhesives, Dental Cements, Etc.

Heat Needs Also Make Field for Gas in Metal Cement Manufacture Promising

By GILBERT C. SHADWELL

In the last article dealing with a similar subject details of adhesive cements generally were given. It is now proposed to speak of certain particular adhesives, such as those used by dentists, joiners, leather workers and many others.

The first of this kind is known as casein adhesives or cements. Most gas men will even doubt the fact that it can be used for such a purpose; but it is a fact, nevertheless. Casein is, in effect, nothing but a modified form of cheese. It is used for a number of cements, etc., which are useful and, if prepared from pure casein, very permanent. The cements from casein and lime are especially good.

Preparing the Pure Casein

Pure casein is prepared in the following manner: Milk is skimmed carefully until there is not a trace of cream. It is then allowed to stand in a warm place until it curdles. It is then washed through into a tin can with a tightly fitting cover, and kept in a cool place.

In using the casein cements and adhesives the edges of the articles must be perfectly clean and the thinnest possible coating put on both surfaces and put together with as much pressure as possible and set aside in a dry place for several days.

When made on a large scale a suitable cauldron furnace heated by gas is of valuable assistance.

Celluloid Adhesives

For the repair of celluloid articles several adhesives are employed, but most of them are made "cold" and, although of interest as adhesives, are of only passing interest to the industrial gas man. It suffices to say that the basic ingredients are celluloid solvents, such as ether, alcohol, amyl acetate, acetone and sulphuric ether.

A so-called glue for celluloid, however, is made of 2 parts of shellac, 3 parts of spirits of camphor and 4 parts of alcohol. These are mixed together while slightly warmed in a water-jacketed kettle. This glue may also be used for fastening together celluloid and wood, or celluloid and tin plate, or other similar metals and materials. It is applied hot, but cannot be exposed to the air when not in use without it hardening prematurely.

Dental Cements

Dental cements are used by some dentists to quite an extent, but by others more sparingly. Nevertheless, the business is one by itself and gas as a fuel enters largely into the manufacture of not a few of them.

One of these dental cements is made as follows: Two parts of pure grain tin, 1 part cadmium and 1 part beeswax. These are melted together in a porcelain crucible, at a heat not exceeding 600 deg. Fahr., in a muffle furnace or by other convenient means, and the alloy is then cast so as to form a small ingot, which when cold must be reduced to filings. For use a small quantity of these filings is formed into an amalgam with mercury. The excess of the latter is squeezed through a piece of chamois leather and the amalgam at once is applied to the tooth. Its color is intermediate between that of silver and tin, but it is said not to darken so readily as the simple amalgam of those metals.

Another cement consists of powdered glass, 5 parts; powdered borax, 4 parts; silicic acid or pure silicon dioxide, 8 parts, and zinc oxide, 200 parts. These are powdered very finely and mixed together. This is then tinted with a very small quantity of golden ochre or manganese. The compound, mixed before use with concentrated syrupy zinc chloride solution, soon becomes as hard as marble and constitutes a very durable tooth cement.

There is a cement made in a rather involved process which now deserves our notice. This is made as follows: Zinc oxide, 500 parts; powdered manganese, 1.5 parts; yellow ochre, powdered, 1.5 to 4 parts; powdered borax, 10 parts. As a grinding liquid

acid-free zinc chloride is used. This latter is prepared by dissolving pure zinc, free from iron in concentrated pure hydrochloric acid, in such a manner that zinc is always in excess. When no more hydrogen is evolved, the zinc in excess is still left in the solution for some time. The latter is filtered and boiled down to the consistency of syrup. Commercial zinc oxide cannot be employed without previous treatment, because it is too loose; the denser it is the better it is adapted for dental cements and the harder the latter will be. For this reason it is well, in order to obtain a dense product, to stir the commercial pure zinc oxide into a stiff paste with water to which 2 per cent of nitric acid has been added; the paste is dried and heated for some time at a white heat in a crucible. After cooling, the zinc oxide thus obtained is very finely powdered and kept in hermetically closed vessels so that it can absorb no carbonic acid. The dental cement prepared with such oxide turns very hard and solidifies with the concentrated zinc chloride solution in a few minutes. In place of the zinc chloride cements, phosphate-zinc cements are of late more and more gaining ground. They all consists of zinc oxide and a thickish liquid of meta- or pyro-phosphoric acids.

There are a number of other similar dental cements, but they are hardly of interest in the present article.

Adhesives and Cements for Glass, Porcelain, Crockery and Marble

Among the foremost of the adhesives and cements used for the above purposes is one which is made as follows: Shredded Russian isinglass, cut Penang isinglass, water, absolute alcohol, acetic ether, gum mastic, gum ammoniac and sandarac are mixed together in suitable proportions. These are macerated in distilled water at a temperature not exceeding 70 deg. Fahr. for twenty-four hours. All superfluous liquid is strained off by letting the swollen gelatine remain for a few minutes on a stretched coarse towel. After this they dissolve at a gentle heat in the smallest possible quantity of alcohol of 50 deg., and strain through a cloth to remove the muscular fibers. There is then added to a portion of absolute alcohol 5 per cent of its volume of acetic ether, and in this is dissolved as much of the following mixture as will make a liquid of the consistency of syrup: Gum mastic, 1 part; gum ammoniac, 2 parts; sandarac, 3 parts. The solution of gelatine and the solution of gums are mixed in equal parts so as to thoroughly incorporate the mixture. This is then put up into small bottles and corked well. When required for use it is heated in a water bath until fluid—just in the same way as regular glue in a water-jacketed glue heater.

There is a patent adhesive or cement which is sometimes known as Carlsbad Patent Cement. This is made of two separate materials. The first is made of water glass of 1.340 specific gravity; the second is made of 1 part of washed chalk and 19 parts of kaolin. This mixture is alternately replaced with baryta white or precipitated barium sulphate. The object has first to be warmed. Then the first and second of the above are mixed to a thin paste and the edges of the article are smeared with it and pressed together. It takes about twelve hours to dry.

We have spoken of casein and its uses as a cement. It therefore may be stated that casein dissolved in soluble silicate of soda or potassium makes a very strong cement for glass or porcelain.

Gas is almost essential in the manufacture of the following German cement, and a soft-metal furnace or cauldron furnace can be used to good advantage for carrying out a part of the work. This excellent cement for glass or earthen ware is made as follows: Gum shellac, 2 parts, and Venice turpentine, 1 part. These are fused together in the furnace as mentioned and when partially cooled formed into sticks. Care has to be taken while the materials are fusing, as the turpentine is very inflammable. When it is used it is melted by gentle heat, in a similar manner to regular glue in a glue heater. An alternative is 2 parts of litharge and 1 part each of unslaked lime and flint glass. These are pulverized separately and mixed. When used it is wetted with old drying oil.

Other cements and adhesives are made along similar lines; and although there are numbers of them for the same purpose, as well as others for crockery ware, glass, porcelain and china, yet it would be but a tedious task for the reader to wade through all the formulas covering them.

Special Adhesives and Cements

There are, however, several cements and adhesives for special purposes which may be referred to at this time. Among these are cap cements (so named because they are used to fix on parts of apparatus to glass), chemical cement, cement for fixing enamel and porcelain letters to glass, glazier's solvent, grinder's cement, lens cement, marble cement, meerschaum cement, cement for wash basins, and so on.

One of the cap cements is made as follows: Best white glue, 11 oz.; white cured soap, 1 oz.; plaster of Paris, 3¼ lb.; water, ½ gal. The glue is put to soak in just enough water to cover it. When properly softened it is dissolved, together with the soap, in the rest of the water, previously heated to 212 deg. Fahr.

When a quantity of the cement is required, a sufficient quantity of plaster of Paris is mixed up quickly with enough of the liquid (made warm) to form a smooth, thin paste. This paste must be used at once, as it soon hardens by "setting." When set it is impervious to kerosene.

Another kind is made by melting together in a small kettle 5 lb. of rosin, 1 lb. of beeswax and 1 lb. of dried Venetian red. Again, a third kind is made from 14 parts of black rosin, 1 part of red ochre and 1 part of plaster of Paris. The latter is well dried and added while warm. The mass is heated to a little over 212 deg. Fahr. It is agitated until all frothing ceases and the liquid runs smoothly. The gas can then be turned out and the contents are stirred until sufficiently cool for use or for packing for shipment. Occasionally one-half part of linseed oil is added to this adhesive, which improves it apparently, although to what extent the writer is unable to learn.

Chemical Cements

Among the chemical cements may be mentioned

(*Continued on page* 351.)

No Circumstances Apparently Under Which Public Is Willing to Concede Utility Employee's Right to Strike

Labor Situation Demands Clear Thinking and Courageous Expression—Problems Will Not Be Solved By Being Allowed to Lie Dormant

By WALTER A. FAIRSERVIS

What interest does the general public take in the labor situation in public utilities, particularly when there is no strike that is vitally affecting it? That question seems to have been pretty generally asked and in almost every case the answer apparently has been the same: the public is keenly interested and this interest is becoming more general each day.

That the interest which is taken is national in scope is shown conclusively, in the opinion of the writer, in a referendum vote taken by the Chamber of Commerce of the United States of America on the question of the rights of labor and capital. This question, while not expressed in exactly those terms resolved itself into a vote as to whether public utility labor has a right to strike under any circumstances and also as to whether public opinion favored the establishment of a commission which would have the power to arbitrate the differences which may arise from time to time. In other words, any awards that might be made by this commission would be abided by by both parties.

The establishment of such a commission would of course have to be done by the enactment of suitable laws and its power would have to be clearly defined.

Opinion Overwhelming

Before entering into a discussion as to whether such a commission would work out we will first set forth the results of the vote of the Chamber of Commerce, merely stating, by way of explanation that the body is composed of similar local bodies and is supposed to represent several hundred civic organizations.

Under a general heading of "Regulation of Employment Relations to Public Service Corporations" numerous questions were asked, which were summed up in the special bulletin issued by the Chamber of Commerce of the United States in two sections.

1. The committee recommends that strikes by employees of all public-service corporations performing public service essential to the lives, health, security, comfort and well-being of the people should by law, be explicitly prohibited.

2. The committee recommends that suitable tribunals should be created by law to adjudicate differences between the employees of public-service corporations and their employers, and that the decisions of such tribunals should be final and binding upon both parties.

The voting resulted as follows: In favor of section 1, 1,570, opposed 100; in favor of section 2, 1,579, opposed 103.

It must be said by way of explanation that the questions which were presented to the member bodies were the result of long study and investigation by a special committee which had been selected to do this work because of the fitness of its members and because of their acquaintance with the problems.

The big outstanding feature that particularly impresses a casual reader is the fact that the public as represented in these civic bodies is absolutely opposed to strikes by employees of public utilities. There can be no circumstance, it seems, under which the public is willing to concede the right to strike to labor where it is working in a public utility industry. It is willing to provide a proper place where the grievances of both sides may be heard but it is not willing to allow any essential to be cut off in order that the ends of any body of men may be served at the risk of the health and security of the many. Those are the brief conclusions to be drawn by a cursory examination of the result of the vote.

Let us see, then, how this applies to the gas industry. From the experience that has gone it would seem that the recommendation of the chamber that suitable tribunals be established, is almost impractical. The precedent that stands out most clearly is the War Labor Board, which, as will be remembered was composed of prominent men, whose decisions were felt to be above any petty objects to be gained personally.

The War Labor Board attempted to adjudicate differences between employee and employer in corporations that were necessary for the well-being of America during the World War. But, we believe from such information as is readily available that the board was a failure. It attempted to function broadly, but its very efforts in this direction defeated its purpose.

The Worker's Mode of Procedure

The experiences of most large employers of labor is that the working man having once set his mind on any object will not wait until it has been argued pro and con, but instead, he puts a time limit on the granting of his demands and when this limit has been reached he strikes unless his wishes are granted. That is human nature and it is an element that will enter every dispute without the question of a doubt. Now a commission to adjudicate differences intelligently must have all of the facts and hear every argument presented by both sides. Then having heard these two it must weigh the evidence and then render a decision which will be just to the party most concerned—the general public. All of this takes time, at least it did for the War Labor Board, and even under war-time conditions the awards of the board were not always accepted in the sense in which they were rendered. Then, too, it is necessary that there must be an order of inquiry, that testimony must be presented in a legal way and that certain forms must be observed. It goes without saying, almost, that employers would be able to abide by the rules of the commission, through

the employment of lawyers, but the laboring man would be working under a handicap that it seems could not be overcome.

It seems that a national commission would of necessity be so large as to be almost unwieldy, particularly if it had to follow through a dispute from its very inception. The final opinion would have to be given by a man who would not have heard any of the arguments and who would not be familiar with local conditions except from the record which was then before him.

If there is to be any regulation of labor in the public utility field, it would seem that it would best be done by means of local or State commissions. These commissions, operating somewhat similar to the public service commissions that control utility companies in most States, would have to operate under State laws and probably be responsible to the Governor. This at once brings up the question of politics entering into the subject and that item alone would serve to bar any such commission from functioning. Labor disputes whether of wage, conditions or what not must be removed as far as possible from politics and political influence.

What Form Regulation Will Take a Question

That there must be some form of regulation of labor in the public utility field, the writer believes that every gas man will agree, but just what form this regulation is to take is a question that offers too many possibilities for a hasty conclusion. Talks with gas company officials have not aided in solving the problem for they are inclined to avoid giving any opinion when possible.

Of course, no answer need be sought from leaders of the great political parties, nor, for that matter, from Government officials until after election for an opinion is too apt to be twisted by political opponents and used against the one who has had the courage of his convictions.

Just what use the United States Chamber of Commerce will make of the referendum cannot be foretold. It is likely that an attempt will be made to secure legislation of some nature on the subject, but it would seem that a more logical use would be to spread the result broadcast in the United States that the thinking people may then know how some other section regards these matters. Sufficient pressure brought to bear in this way will notify those radicals who preach unrest that public utility companies must be left severely alone if some drastic action is not to be taken.

While it is true that most of this article has dealt largely with the public utility field generally and not specifically with the gas industry, the entire subject is so closely interwoven with the welfare of this field that we believe the space taken up in these pages is justified. We are convinced that the gas man prefers to allow some other branch of industry to inaugurate a movement to solve this tremendous question, but we feel that the importance of industry warrants our taking a place in the forefront and with pressing our claims to the fullest.

Tendency to Avoid the Issue

In this connection it has been a very noticeable fact that gas company executives are hesitant about expressing their opinions on the labor question. This has been particularly noticeable in the efforts of the writer to secure interviews on this subject. Every man approached is willing to talk and discuss the problem but when it comes to seeing these expressions in cold print then they decline to talk. It has even taken a great deal of persuasion to get them to be quoted without using their names. They seem to feel that the subject is charged with dynamite and an explosion is likely to occur any time. This does not impress us as being the proper attitude for the leaders of an industry to take. A determined stand on the subject and a full discussion will serve to clear up many of the doubts that are now existing and these opinions will carry additional weight when they are given over a man's signature. The labor problem is a big one, bigger indeed than any individual but it is not to be solved by being allowed to lie dormant. Sooner or later it must be faced and when the time comes those who are armed with plenty of ammunition are the ones who will arrive at a solution.

Automobile Cost Accounting

A. G. A. Committee Outlines System of Accounting that with Slight Variation May Be Used by Both Small and Large Companies

The committee has endeavored to outline a system of accounting which would be applicable to both a large and small company, using one or more makes of cars and various capacities. We believe that with slight variations, depending upon the detail required, that this system can be made to fit into any standard method of accounting which is planned along the line of the uniform system of accounts as adopted by the American Gas or the National Electric Light Association, whether or not a company operates one or more utilities.

The first step is to outline the accounts necessary to segregate the expenses of operation in such a way as to furnish the desired information as to costs. The following points have been taken for granted. That all transportation equipment is charged to a capital account at the time of purchase. That depreciation of equipment is taken care of through a general depreciation policy basis upon the gross revenue or unit basis. Depreciation therefore has not been considered, although if any company wishes to maintain a separate depreciation item for transportation equipment it would only be necessary to add an additional expense account and provide for a separate sub-account of the general depreciation reserve. When there is to be a major repair the same problems will be experienced, as in case of major repairs of machinery the question would be, should the replacement be charged as a maintenance expense or to depreciation reserve.

The apportionment or clearing account for accumulation of costs would be headed as follows:

a. Chauffeur's wages and expenses.
b. Gasoline.
c. Lubricants.
d. Miscellaneous supplies.
e. Licenses, State, city and chauffeurs' license.
f. Insurance.
g. Tires, including repairs.
h. Repairs, labor and material.
i. Overhauling, labor and material.
j Garage repair, shop labor.
k. Garage repair, shop material.
l. Garage expense.

It is quite important that each vehicle be assigned a

(*Continued on page* 351.)

Taking All Factors Into Consideration Gas Can Be Proved Least Expensive as Well as Most Economical Fuel for Asphalt Melting

C. H. Kallstedt Discusses Subject in Light of Present-Day Conditions and Future Possibilities—Roofing and Shingle Making Branches of Industry in Midst of a Period of Unprecedented Activity

Asphalt is the name given to a compact form of bitumen, which is usually black or dark brown in color, explains C. H. Kallstedt, of the Peoples Gas Light & Coke Company of Chicago in a paper prepared for the American Gas Association convention. It is most commonly found wherever rock oil occurs, and in such localities is produced by the drying up of the petroleum. In some places, however, it is found in beds forming a compact rock. Or again, it may be nothing more than the residue left after the different grades of oil are abstracted from crude oil.

Uses for Asphalt

The uses of asphalt are numerous, but without question or doubt, the largest percentage of asphalt is used for road building and pavements. Asphalt used for these purposes contains from 25 to 35 per cent clay and sand. Other ingredients are then added in order that the proper mixture may be obtained.

The next largest percentage of asphalt is used by the manufacturers of asphalt shingles and roofing. These manufacturers are found throughout the country. Approximately 100 are members of the Roofers Association, and doubtless there are many companies like our own association that are not members, so it is nearly impossible to give the exact number of plants in operation. The method of manufacture with all will be found very similar.

Asphalt refiners are also large users of asphalt. Here asphalt is refined and mixed with other ingredients to make rubber heels, all rubberoids, automobile tires, many so-called genuine leather seats, chewing gum, etc.

The use of asphalt covers a wide and important range, and in all instances some source of heat is necessary before the objective can be obtained. The asphalt paver must heat his material in order to combine it with sand; the manufacturer of asphalt products must heat the asphalt in order to saturate his paper properly, or to coat the roofing or shingles; and the refiner must obtain very high temperatures before he can secure results. Therefore, the method of melting or heating the asphalt is an important process, and consequently the heat medium employed assumes relative importance. That this process be consummated in the quickest, most efficient and economical manner possible is a fundamental requisite.

Method of Melting Asphalt

The greater percentage of the heating tanks or stills used by pavers are of a portable type and are far from being efficient. Within a short time, I am sure we will see some radical changes in the construction of this equipment, especially if the prices of coal and oil keep advancing at their present rate. When this occurs, the gas company should secure this business.

Manufacturers of asphalt products and refiners have their permanent plants, and these will not be moved. In such plants, the still and tank equipment generally represents an outlay of money far in excess of machinery, apparatus, and other equipment. It is in these stills or tanks that the asphalt is melted and heated to the required temperature.

Formerly, the only fuel used in the roofing industry was coal, and passable results were obtained. Later the "Oil Man" designed new installations which were favorably accepted by the companies, for upon trial it was found that they increased production by making it possible to maintain a more even temperature. The result was that the majority of plants now have large oil storage tanks on their property, and are using oil as a heating medium.

It is now high time for the "Gas Man" to step in and assert his rights, for gas is the logical and best heating medium for this class of work. The use of gas for melting and heating asphalt, in roofing plans is at present not very common. However, this need not necessarily make it difficult to secure new consumers, for gas used for such purposes is no longer in the experimental stage. It has been tried, proven highly satisfactory, and is permanently installed in a number of plants. Besides, its advantages as set forth below, have proven so marked and so definite, that there can be no question of the efficiency and value of gas.

Even the question of high gas rates need not figure as an obstacle, nor the question of "junking" the present equipment, for all these apparent difficulties can be surmounted, and in fact have been, and the manufacturers can and have been convinced of its advantages and possibilities

Naturally each class of work and each individual plant must be carefully studied. The engineer must ascertain the method of operation, materials to be melted and all the numerous details peculiar to each individual plant, so that the most economical installation can be used. Unless these factors are carefully observed and taken into account in determining the best application of heat, it will be difficult to convince the prospective consumer. The exceedingly high price of wooden and tile shingles has made the demand for asphalt products increase to such an extent that the asphalt shingle and roofing companies are unable to fill their orders, even though plants operate day and night. Naturally any improvement in method of operation or otherwise that enables the companies to increase their output without a comparative increase of expense, is a desirable proposition. Something must first be known of the method of operation in such plants.

The felt paper of which shingle or roofing is made,

is of various grades and thicknesses. It is usually first passed through a drying room and a considerable amount of moisture is absorbed from the paper.

From the drier the paper passes through a saturation tank. This tank contains asphalt at a temperature of from 400 to 475 deg. Fahr. By passing the paper through this tank several times it will become thoroughly saturated. It is very seldom that the asphalt in this tank is heated with direct heat, because of the fire hazard. It is generally heated in an outside still, and circulated between the two tanks in order to maintain the desired temperature. The higher temperatures of saturation are an advantage, as the lighter oils are broken up and paper will saturate much more quickly. When thoroughly saturated and cooled the paper is coated with asphalt which is most commonly kept at a temperature of from 300 to 400 deg. Fahr., after which the grit, stone or whatever finish is desired is applied. There are other processes necessary for the paper to go through before we have a finished product, but for them no heat is required.

Asphalts used as a saturant are of various kinds. Some roofers use a large percentage of liquid asphalt with fluxes. Others use the hard asphalt. The degree of heat required depends upon the kind of asphalt and felt used. Also one will find that the specific heat of asphalts are not all alike. The coating is most often of hard asphalt, in order that the finished product be hard. This asphalt requires a great amount of heat to melt, but the temperature required is rather low. There are three methods of maintaining saturants at the correct and desired temperature:

First. By circulating the asphalt from the still to the saturant tank.

Second. By circulating hot oil through coils submerged in the saturant tank.

Third By heating the saturant tank direct. The first two methods are proper and advisable, but the third is entirely undesirable, because of the increased fire risk. I would not suggest gas being used in such a place.

The majority of the asphalt plants employ the first method mentioned, *i. e.*, they heat and melt the asphalt in stills or kettles in some isolated part of the plant, and then circulate the asphalt from the still to the saturation or coating tank. By circulating the asphalt in this manner the required temperature can be maintained, but there is always a drop in the temperature of the asphalt from the still to the tank. This drop represents just so much loss in heat, or in dollars and cents, which at the average plant will amount to a large sum of money in a year.

The second method, i. e., by circulating hot oil through coils submerged in the saturation tanks, is by far the most efficient. Here it may be advisable to insert a few paragraphs explaining the oil circulating system. This method has been developed and perfected in recent years because of the increasing demand for a heating system applicable to high temperatures, in which the delivery and transfer of heat is positive and under easy control, and from which the difficulties of steam and the fire hazard of direct-fire heating have been removed.

The Hot Oil Circulating System of Heat Transmission

The answer to the heating problem was found in the development of a system of "Fluid Heat Transmission" using a specially refined crude oil derivative as the carrier of the heat, and consisting in addition to the circulating oil of a heat generator or absorber, a circulating pump, an expansion tank, gas burning equipment and the pipe lines with accessories.

When rigid limitations must be met, it is obvious that the fuel used must be such that the fire is easily controlled. It is necessary to have maximum fire instantly, or be able to reduce the heat load at will. These conditions can only be obtained by a fluid type of fuel, controlled either automatically or manually at the furnace.

What lends itself better to meet these requirements than gas? Engineers soon recognized the value of gas for this system and in every installation where it has been used to fire the absorber, it has given the greatest satisfaction to the owners by its simplicity, and flexibility.

Installations have been made in a number of asphalt roofing plants. Due to uniform temperature, the machines can be operated at constant speed, and because of the high saturant temperatures that can be carried, they can run the felt through the saturant at a maximum speed thus increasing the hourly production and insuring a product of the highest quality and uniformity.

The hot circulating oil at approximately 475 to 500 deg. Fahr., can be passed through pipe coils set inside the tanks or passed through jacketed tanks if necessary

Both saturating and coating tanks operate from one oil heating system and the temperature of each is independently controllable by special oil by-pass valves installed at each piece of apparatus.

The study of the transfer of heat is also very interesting. The conductance of the film between the pipe coil and the asphalt is about 10 B.t.u. per square foot per hour per degree difference in temperature. But because the conductances of the pipe and the film on the oil side is so high compared to this value the overall co-efficient is practically ten.

The absorber or heater is a tubular constructed machine mounted on a neatly designed furnace with dutch oven extension. The tubes are expanded into heavily designed cast headers and opposite the end of each tube is a plug which is easily removable and permits inspection and cleaning if necessary.

Careful engineering, and a great deal of research work was necessary in designing this piece of the equipment and such points as the length and size of tubes, the velocity of the circulating oil and proximity of the fire to the tubes all required careful study.

The oil-circulating pump must be of known and positive displacement and provision must be made for relieving the pump of a part of its duty when starting a system from low temperature after it has been shut down over night.

An expansion tank is provided to allow for the increased volume of oil due to expansion when the system is brought up to the required circulating temperature. It also serves as a liquid seal for the system and insures the exclusion of air. Its location and point of attachment to the transmission lines are of vital importance.

Several different makes of gas burners of both the high and low pressure type are in successful use on installations of this kind. They are entirely satisfactory to the owners, and pronounced satisfactory by gas engineers who have inspected these plants.

The advantages of using gas for heating are plainly evident on inspecting machines which have been operated on gas fuel for several years. The inside of the tubes have been regularly inspected on six-month periods and it has not been necessary in three years' time to clean or replace a tube. The oil has been circulated

at approximately 525 deg. Fahr. during this time. No scale or oxidation has taken place on the exterior tube surfaces, as perfect combustion is easily obtained and no excess air is necessary. The refractory lining also shows an excellent condition and furnace repairs are practically unknown.

The pressure on the pipe lines transmitting the hot circulating oil rarely exceeds 15 lb. per square inch so that standard-weight steel pipe has been used for several years with perfect satisfaction.

No corrosion takes place as the fluid itself actually preserves the pipe. Due to the high temperature and fluidity of the circulating oil, the pipe lines must be constructed to prevent leakage. The only satisfactory method as determined in actual practice is to use steel flanges welded to the pipe and metal gaskets of special design placed between the flanges. It is advisable to reduce the number of joints to a minimum, so that bends and offsets are used instead of fittings. These parts also lower the pipe friction head and assist greatly in taking care of the line expansion, which by the way is approximately 1/32 in. per linear foot of pipe. Threaded joints can be used only on small piping below 2 in. and must be made up with a special compound that is not affected by oil or heat.

These systems can be built in a number of different sizes ranging from 50,000 to 1,500,000 B.t.u.'s per hour. There is no known limitation to the size of these machines and therefore it can be expected that larger unit equipments will be built after sufficient research has been accomplished. Where a greater quantity of heat is required than can be delivered by one absorber, two or more machines can be connected in battery similar to steam boiler practice.

The efficiency of a properly designed and operated system makes this method of heating very attractive to the manufacturer. The thermal efficiency of these absorbers is about 60 per cent. Compare this with the efficiency of direct fire under the vessel which is from 10 to 20 per cent and it is readily seen to be a factor worthy of consideration. To obtain high efficiency the gas velocity and its passages, the velocity of the oil through the tubes and the size of the furnace must be carefully computed.

Systems of large capacity have been in operation for a number of years; some on 25 hour a day service with only the attention that machinery in general ordinarily requires . The pump being the only moving part of the system, its maintenance cost is practically negligible because it is handling a material which is in itself a lubricant.

It has not been necessary to remove the circulating oil from a system and recharge with fresh fluid. A shrinkage on the average of 1 per cent per week takes place which is replaced with fresh oil poured in the expansion tank.

Systems operated for a period of over three years have absolutely no carbon in any part of the heater. The tubes, internally and externally, appear to be in the same condition as they were on the day when first put into service.

The method of a hot-oil circulating system for low temperature heating purposes is most versatile, for wherever steam or any other source of heat is used, a hot oil circulating will undoubtedly give better results and greater economy since temperatures up to 500 deg. Fahr. can be easily maintained by thermostatic control.

The third method mentioned, by which the asphalt in the saturant tanks is heated by direct fire and a temperature is maintained in the same manner, is used by some plants. It is a system to be avoided wherever possible because of the fire hazard.

In the application of gas, it is imperative that no flame be under the saturation tanks, for if a fire should occur, due to the high temperatures maintained, and the inflammable materials used, gas would be held responsible.

Importance of Maintaining Correct Temperature

The maintenance of the correct temperature in the saturation tanks is a most important item. Even though some manufacturers may not at first concede this to be a fact, it must be remembered that the production in this type of plant is solely dependent upon uniform heat.

If the temperature drops, the machine must run slower in order to saturate the paper sufficiently. A great number of "seconds" will be found if the temperature is low, so not only the amount of production suffers, but the quality also. If the temperature of the asphalt is too high the paper will be burnt, and breaks or tears are frequent. The machine must then be stopped and rethreaded, incurring a loss in production and an idle working force. Consequently, temperature maintenance becomes one of the most important factors in the industry.

As temperature control is impossible with coal, and difficult with oil, the gas engineer comes armed with advantages and possibilities that the others cannot compete with. With gas, an automatic temperature control device is possible and takes care of this important item without requiring any attention or care.

Temperature control is in my mind the greatest advantage of gas over all other fuels.

There are three fuels in general use for the melting and heating of asphalt: coal, oil and gas. While it appears an easy matter to choose the most economical fuel for any plant, a little study will disclose the fact that a very thorough investigation must be made before the right one can be selected.

Asphalt possesses several characteristics which cause difficulty when an attempt is made to heat it. The thermal conductivity of asphalt is low, and consequently when heat is applied to any considerable quantity of it, portions of the mass become overheated before other portions become affected. At excessive temperatures the asphalt "cracks" and a deposit of coke is formed which is practically impervious to heat. The presence of moisture in asphalt causes it to foam when heated. Foaming in turn introduces a great fire hazard, because of the exceedingly inflammable nature of this material.

It is unquestionably true that the managers of roofing plants have based their choice of fuel largely upon a study of bare fuel costs only, otherwise they would not, so generally, have adopted coal for their heating processes. Of the three fuels mentioned, coal is the one most difficult to control, and perfect temperature control is absolutely essential if maximum production is to be obtained.

There is little doubt that solid fuel should be entirely abandoned for this class of work, unless local conditions are such that its cheapness offsets all of the numerous advantages to be gained from the use of liquid or gaseous fuel.

As the whole problem hinges on the question of temperature control, and as there is no doubt that a gas fire is superior to an oil fire in this respect, very careful consideration should be given to the proposition before

a choice of either one of these fuels is made. All of the factors, such as maintenance, fuel, equipment and overhead costs should be taken into account, and an accurate estimate made of the value of improved quality of the product and better working conditions, which are secured with gas fuel.

Changing from Oil-Fired to Gas-Fired Apparatus

In remodeling an oil-fired still to burn gas, the usual method employed is to remove the primary combustion chamber or tunnel and reduce the volume of the secondary combustion chamber as much as possible in order to minimize the heat losses. A pipe burner equipment with blast tips is then extended back through the combustion chamber under the still. This burner is kept at a sufficient distance from the bottom of the still to prevent the flame from impinging on the steel shell, and in this way the trouble caused by the tendency of the asphalt to coke on the bottom of the still is alleviated.

The still or kettle may be gas fired with direct heat or by a hot oil circulating system. When firing direct, we have found that a pipe burner with blast tips gives the best results. The amount of gas consumption varies from 500 to 1,500 cu. ft. per hour, depending upon the size and construction of the still, kind of asphalt to be melted, and the amount of asphalt to be melted per hour. Care should be taken that the pipe burner does not become too hot, or trouble may be found in back firing.

In burning gas the necessary air to support combustion may be secured in two ways. Under one plan, air is supplied from a fan blower at a pressure of from one-half to one pound per square inch and is mixed with the gas by means of a siphon tee. With this system, the flame is generally regulated by means of two valves, one in the gas and one in the air line, but it is possible to provide a mechanical means of operating both valves with a single control, if so desired.

Under another method, the gas pressure is raised to about five pounds per square inch and the air necessary for combustion is entrained through an inspirator. With this system, the air is drawn into the inspirator because of the partial vacuum induced at the air inlet ports, due to the fact that the pressure back of the gas causes it to issue from the inspirator orifice at an exceedingly high velocity.

With a high pressure gas system, the flame is controlled with a single valve, and consequently the problem of installing thermostatic control can be very easily solved.

Another item which has not been given the consideration and importance it deserves, is the unfailing availabiliy of gas. By having gas at the factory door 24 hours per day, 365 days per year, being able to use it whenever it is wanted, by merely opening a valve, is a feature and advantage only too frequently overlooked or forgotten. Present day deliveries of commodities, and in fact of necessities, are irregular and undependable at best, so fuels such as coal or oil become only an added worry to the manager, for he is never certain to have enough storage on hand until the next shipment arrives. However, it is a difficult matter to place a dollar and cents valuation upon service such as gas would offer. Instead of being lightly overlooked or set aside, this really should be considered an important factor to any prospective consumer.

Advantages of Gas Over Other Fuels

Once again the fire risk assumes importance and demands consideration. When coal or oil are used as fuel in the heating of asphalt, the combustion chamber or fuel box becomes red hot, and if the operator should be the least bit careless and allow the temperature to rise over 500 deg. Fahr. (flash point), the danger of fire becomes serious. Fires in asphalt plants are numerous and probably 85 per cent of these are due to flashes. Insurance rates consequently are high and almost prohibitive. Very few plants carry insurance for full value as first-class companies consider a roofing plant too much of a risk. Thermostatic gas control eliminates this danger and enables the manufacturer to carry insurance at a more reasonable rate with reliable companies, which is another strong argument in favor of gas.

Storage space is also an important item, and all modern roofing plants could use an unlimited amount of space for that purpose were it available. The manufacturer may not readily see how this applies to gas, but he must call to mind that coal and oil require a great amount of space that could otherwise be used for storage, and in figuring actual costs and expenses a fair rental should be charged for it. In addition, the cost of equipment for such storage, interest upon the money so invested, and the maintenance of the equipment, should be added. Gas requires no space at all, and entails none of the other expenses mentioned.

The actual difference in price of fuel does not enter largely into the question. Coal and oil prices are steadily increasing and are at no time stable or permanent. Gas will be found much more uniform in price. Assuming that gas rates do increase, the increase will not be in proportion to the increase of other fuels. For example, a few years ago, oil sold at 3 cents per gallon f. o. b. plant, and to-day it sells at 11 cents per gallon f. o. b. plant. In other words, it has increased 300 per cent. Gas rates have not increased in such proportion.

It is true that many manufacturers may have favorable and low-priced contracts for fuels, but deliveries are not as regular as they formerly were. I know of one manager who had three tank cars of oil per week contracted for at 3 cents per gallon. When oil prices went up it became difficult for him to obtain his three cars per week. Later he was able to obtain only one car per week, the rest of the oil he needed he was obliged to buy at market price. If a gas company were to do anything similar there would have been newspaper notoriety from coast to coast about the "taking methods of our large corporations."

Another argument in favor of gas is the labor question. With coal as a fuel, labor is required to unload the cars to wheel the coal to the place of usage to handle the ashes after the consumption of the coal. There is also a great amount of labor required for hand firing. Almost the same is true of oil. It must be pumped from the cars to tanks and again through the oil lines. I have recently noticed that men are watching their oil burners very closely in order to get as nearly perfect combustion as possible. This is no doubt due to the high prices of oil. At one plant I figured 10 cents per hour per still for supervision of oil burners, a very conservative figure. This is an unnecessary expense and can be entirely eliminated upon the installation of gas and its automatic control. Labor is very

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As the Journal Views It

"Plenty of Oil if You Can Pay the Price"

Little fault can be found with the attitude of the oil industries as expressed by R. L. Welch, secretary of the American Petroleum Institute, at a conference with spokesmen of the gas industry in conference at the headquarters of the American Petroleum Institute. Frankly expressed, it is:

"There is plenty of oil if you can pay the price."

As a price fixer history has shown no better system than the law of supply and demand.

If fuel users, steamships, etc., are willing to pay a higher price than the gas industry, then clearly they are entitled to the oil.

Nor can the outcry of "gouging"—profiteering—be justly raised against the oil industry.

The price its product is now selling for bids fair to bring its own remedy.

With such a bait to tempt it on capital may perhaps be led to put up the expensive plants needed to educt oil from shales.

Utterly unable to pay the price necessary, gas companies will have to produce gas with a minimum or no usage of oil. Oil fuel users in numbers may be driven to adopt gas.

Oil companies will realize that profiteering does not pay. It may bring ten dollars extra to-day, but at the cost of thousands perhaps in the passage of years.

For this reason profiteering charges must be taken with a considerable grain of salt. The oil industry may perhaps be accused justly of a number of things that have not met general approval. It cannot be accused of lack of business intelligence and foresight.

Present selling prices of oil are such, despite dimin

ishing reserves, as to threaten their continuance in two ways: Bringing in competition, and curtailing consumption.

Reaping an Excellent Harvest

As one visits around suburban dwellings and city apartments these evenings it is seldom he is not seated in a room where a gas heater of the portable type is in use.

At this point of the fall season in the old days a goodly number of central heating plants would be in operation. But lessons derived from war-time fuel curtailments and the influence of present-day high coal prices have given the people of this country a new viewpoint as to the time when the heater should be put into operation.

We're willing to forego that cozy feeling and heat now, when we are compelled to by the central heater plant method, only when the chill reaches a point where it becomes a health menace.

It is questionable if the season has been cold enough yet to actuate one in going out and buying an auxiliary gas heater.

But a little artificial warmth even in one room has been enough quite often to make the whole house comfortable. Even the little, occasionally lighted water heater in the kitchen has contributed much in this direction.

Yet when one already has a gas radiator or other type of gas heater in the living room, dining room or some other, the temptation to light it up once or more a day at least is almost irresistible. At small cost it supplies the difference between a perfectly homelike atmosphere as against an almost homelike setting.

Thus gas companies with a large number of individual gas heaters on their lines are now reaping an excellent harvest in increased gas consumption; such a harvest indeed as to impress one with the exceeding desirability of never ceasing in our efforts to push the installation of this class of appliances.

Taking All Factors Into Consideration Gas Can Be Proved Least Expensive as Well as Most Economical Fuel for Asphalt Melting

(*Continued from page* 348.)

scarce and expensive, too, so this item should also be given consideration.

Cleanliness, an all important factor, must also be considered. Roofing plants at their best are dusty, but the use of coal or oil as fuel makes the working conditions much worse.

Comparative Costs of Gas vs. Oil

The following tables will show the results obtained from oil and gas tests taken on the same asphalts, approximately 210 deg. Fahr. melting point. The tests were conducted under ideal conditions and very good results obtained:

Oil Test—Three Days

Fuel oil consumption	152.25 gal.
Fuel oil consumption, average per hour	3.55 gal.
Asphalt melted	25.03 tons
Fuel oil consumption per ton of asphalt melted	6.11 gal.
Average temperature	360 deg. Fahr.

Oil cost 11 cents per gallon at burner (9 cents f. o. b. plant).

	Fuel Oil	Air	Labor	Total
Cost per hour	$0.426	$0.02	$0.12	$0.666
Cost per day	6.09	0.20	1.70	7.99
Cost per ton of asphalt melted	0.7332	0.04	0.16	0.9332

Gas Test—Five Days

Gas consumption	65,600 cu. ft.
Asphalt melted	49.64 tons
Gas consumption per ton of asphalt melted	1,323 cu. ft.
Average temperature	446 deg. Fahr.

The temperature maintained during the gas test will be found much higher than the temperatures maintained on the oil test. For the purpose of comparing costs, the gas consumption has been figured on a basis of 360 deg. Fahr., as was found during oil test.

	Oil	Gas	
Cost per hour.	$0.666	$0.792	(790 cu. ft. at $1 per M)
Cost per ton of asphalt melted	0.9332	0.975	(975 cu. ft. at $1 per M)

Prospective Business

In the Chicago district there are eleven roofing concerns. At present four have contracted for gas with a total consumption of 10,500,000 cu. ft. per month. I have figured that approximately 50,000,000 cu. ft. of gas per month should be salable to this class of business alone. With careful study of conditions and methods employed, gas would unquestionably meet with complete success in a plant of this type, and I would consider a shingle factory very desirable for a gas company to have as a consumer. There is a very small variation in load or consumption from hour to hour, some charging being done through the day, but the bulk is done at night. Consequently the meter and pipe installation is much smaller than in a factory using the same amount of gas during a shorter period.

However, in conclusion, I wish to call attention to the fact that the prospective consumer must not compare the cost of gas with that of other fuels upon a basis of B.t.u.'s. This is a false basis of comparison. The numerous other factors which enter into the final cost are essentials which must not be overlooked, such as temperature control, decreased fire risk, cleanliness, space saving (because of no need for storage), elimination of cost of equipment for storage and of maintenance and depreciation, saving of time (no irregular deliveries), labor saving, and others too numerous to mention. All of these advantages not only equalize the

costs of gas with that of other fuels, but make it even more economical, regardless of the cost of existing rate per 1,000 cu. ft. of city gas.

Automobile Cost Accounting

(*Continued from page* 344.)

number and this number to be shown in connection with all charges. If the company is operating several cars of the same make and of the same capacity, or of the same make and different capacity, it might be desirable to keep a record of expenses by groups of cars, which could be provided for with slight modifications of the above arrangement of accounts.

Where there is variety as to number of cars, makes and capacity, it is suggested that the expenses be recorded by individual car. A ledger sheet can be designed to receive all charges to the various accounts, or it might be found advisable to provide a separate ledger sheet for each sub-account and for each car.

A daily vehicle transportation report should be made out by each driver, this form providing for the number of hours use is suggested as being the most equitable basis upon which to charge for service of transportation equipment.

The second report will be made up by the driver of each vehicle showing the miles traveled, gasoline, oil or charging data, odometer readings, information regarding changing of tires and other data concerning the condition of the machine.

All expenses in the garage should be charged through time reports, material tickets or invoices, direct to accounts interested, and each charge should show the proper car number.

Any charge too small to be charged direct as above, such as washing, minor adjustments together with light, heat, watchman's salary, etc., should be charged to garage expense account. This account to be prorated to each car on the basis of relation of number of hours each car is in service to the total number of hours of all cars.

All charges to daily vehicle transportation report by account number and hours of use to be transferred daily to the monthly vehicle transportation report, and at the end of the month the total hours to be added, arriving at the total number of hours of use of each car for the month.

It is to be assumed that each operating company has an established routine for the purchase of regular and emergency supplies and that such system will provide the necessary forms through which charges will be made to the proper car and clearing accounts will be transferred to the proper work order, job order or expense account in accordance with the hours of use. The rate per hour to be ascertained by dividing the total expense by the total number of car hours.

Use of Gas in Making Casein, Celluloid Adhesives, Dental Cements, Etc.

(*Continued from page* 342.)

one which is used for the masonry of chlorine chambers, sulphuric acid or vitriol works, etc. It is also used as a lining for kegs and barrels intended to hold chloride of lime. This is made of equal parts of pitch, rosin and plaster of Paris thoroughly dried and mixed together.

Another method is to take 4 parts of yellow wax, 2 parts of common turpentine and 1 part of well-dried Venetian red. These are then melted together. This can be used as a temporary stopping or luting for the ends or joints of tubes which are not exposed to much heat.

A good cement for chemical apparatus is made by mixing 40 parts of rosin, 8 parts of wax, 8 lb. of red ochre and 1 part of plaster of Paris. The whole is then melted with moderate heat.

An adhesive for affixing enamel and porcelain letters to glass is made from 15 parts of copal varnish, 5 parts of drying oil, 2 parts of turpentine and 5 parts of liquefied marine glue, which are melted in a water-jacketed cauldon furnace. Slaked lime to the extent of 10 parts is then added.

Another type of cement, which has the advantage that it holds, due to the fact that it takes into account the difference in the rate of the expansion of the glass, is the enamel. This is made as follows: Fifteen parts of fresh quicklime are slaked in 20 parts of water; 50 parts of pure rubber and 50 parts of linseed-oil varnish are then melted together. The mixture is brought to a boil. While boiling the liquid is poured onto the slaked lime little by little with constant stirring, which can be accomplished by running off into another cauldron furnace equipped with an agitator. The mixture while still hot is passed through muslin so as to remove any possible lumps, and it is then allowed to cool. It takes this cement about two days to set completely, but when dry it makes a joint that will resist a great deal of pulling, whether from expansion or contraction or by any other force, such as a wedge to pull apart the pieces united with it. By thinning the mixture down with oil of turpentine a brilliant, powerfully adhesive varnish is obtained.

What is known as grinder's cement is made as follows: Pitch, 5 parts; hard tallow, 1 part, and wood ashes, 1 part. These are melted together.

Another method is 1 part of black rosin and 1 part of beeswax. These are melted; then whiting is added to the extent of 1 part. It must, however, have previously been heated red-hot and be still warm when added.

A cement employed by glass grinders consists of shellac heated in a gas-fired cauldron furnace and applied to the pieces slightly heated. It is used for lenses and fine work.

In lenses of foreign make an arborescent appearance is occasionally to be seen between the elementary parts of which the lens is composed. This arises from the drying or shrinking of the balsam with which it is cemented. In order to remedy this, the lens is unset and placed in warm water. This may be still further heated till the balsam softens. The components are separated and cleaned with ether, benzol or turpentine. After this a drop of pure balsam is placed on the center of the concave surface, and then the convex one is gently pressed down until the balsam spreads and oozes out at the edges. A gentle heat is then applied until the balsam hardens.

Jewelers' Cement

Jewelers employ numerous cements. The uses and corresponding types of these are large, and in-

clude such as amber, meerschaum, ivory, metals, horn, bone, shell, jet, mother-of-pearl, seals, tortoise-shell, etc., etc.

A few of these will be given. Amber cement is made by melting mastic in linseed oil. It is used hot. Another for amber is made by moistening the surfaces with a solution of potash and then pressing them together. Again, the surfaces are smeared with boiled linseed oil, then pressed strongly together and heated over a suitable gas stove. To keep the parts in firm contact it is often well to bind them together with fine soft iron wire.

A cement for meerschaum is made by dissolving casein in a solution of water glass (silicate of sodium). Into this is stirred magnesia. This is used at once.

An Armenian cement used by jewelers is made as follows: Ten parts of gum mastic are dissolved in 60 parts of absolute alcohol; then 20 parts of fish glue are dissolved separately in 100 parts of water in a water-jacketed glue heater; then 10 parts of 50 per cent alcohol is added. After this, 5 parts of ammoniacal gum in 25 parts of alcohol (of 50 per cent). The first solution is then mixed with the second and stirred well so that it mingles thoroughly. Then the ammoniacal gum is added and the whole is stirred again. Finally the whole is put in the water-jacketed glue heater or cauldron furnace in order to bring down the preparation by evaporation to 175 parts only.

The next method is to dissolve 5 or 6 bits of gum mastic the size of a large pea in as much alcohol as will suffice to render it liquid; in a separate vessel as much isinglass is dissolved in spirit as will make a 2-oz. bottle of very strong glue. The isinglass must be previously softened in water, though none of the water must be used after this. Two small pieces of gum ammoniacum, which must be rubbed or ground till they are dissolved, are now added. Then the whole must be heated and mixed together. It is kept closely corked, and when used the bottle is set in boiling water.

The quantities given are experimental only and are used in order to determine the exact proportions when making the material on a large scale.

The preceding is also effectual in uniting almost all substances, even glass, to polished steel.

Thick isinglass glue, 1 part, and thick mastic varnish, 1 part, is also used. The glue is melted, mixed and then bottled. When used it is heated in hot water, as in the case just cited. A similar cement is used for horn and bone, while that for horn and shell is made by dissolving 500 parts of glue in a water-jacketed glue heater or cauldron furnace with 125 parts of alcohol. To this are added 10 parts of pulverized alum and the whole is mixed together while heating. If it is too thick for use it is thinned by means of water.

For ivory the following mixture is used: One part of isinglass and 2 parts of white glue are dissolved in 30 parts of water. This is strained and evaporated by heat to 6 parts. One-thirtieth of a part of gum mastic is then added, dissolved in ½ part of alcohol; 1 part of zinc white is then added. It is used warm.

There are a number of similar adhesives, all having a somewhat similar composition.

Regarding the cementing of jet, shellac is about the only cement used by jewelers for that substance. The broken edges are made warm before applying the adhesive. To prevent the shellac showing it is often the practice to "smoke" it before applying. In this way it becomes the same black as the jet itself.

Mother-of-pearl is handled in the following manner: Isinglass in thin sheets, 4 dr.; mastic, 2 dr.; powdered ammonium chloride, 1 dr.; alcohol, 3½ oz., and water, 4 oz. The isinglass is steeped in the water for a day, and then dissolved by aid of a gentle heat. Sixteen drams of alcohol are added. It is passed through a cloth strainer, and to the hot solution there is added, with constant stirring, the mastic previously dissolved in 12 dr. of alcohol.

A somewhat similar jeweler's cement is spoken of as Turkish; however, another similar kind is used for mending tortoise-shell.

Leather Cements

There are at least a dozen good leather adhesives. Some consist of rubber dissolved in bisulphide of carbon. Others are made from glue, turpentine, alcohol, rubber and gum arabic. In only a few cases is heat employed, but where this is required a gas-heated furnace of the cauldron type (usually water-jacketed) is all that is needed, as a rule.

Metal Cements

It would be impossible to give but a small fraction of the so-called metal cements on the market, but a general survey of them will be taken. There are some cases where soldering, brazing or welding is impracticable and in those cases a cement is employed. In one case there are melted copal varnish (30 parts), drying oil (10 parts) and turpentine (6 parts) in a water-jacketed kettle, and when melted 20 parts of slaked lime are added.

Again, glycerine and litharge stirred to a paste make a fairly good cement for iron upon iron, for two stone surfaces, and especially for fastening iron to stone. This cement is insoluble and is not acted upon by strong acids.

For brass to tin the procedure is somewhat as follows: To about 20 parts of fine reduced copper there is added sufficient sulphuric acid to make a soft paste. To this 70 parts of mercury are added and worked in; at the same time heat is applied until the mass assumes a consistency of wax. The mixture is applied to the metal surfaces, which are heated, and the cement is also warmed to the same temperature.

Cements for iron are made of graphite, whiting and litharge, and mixed with boiled oil or else white lead and asbestos. Again, iron filings and water glass. A number of preparations are on the market for steam, hot-water and hot-air boilers and pipes. These have many varying formulas, but a number of them contain iron borings or filings, sal ammoniac, asbestos and white lead.

Further details of these would be out of place at this time, as but few of them require heat for their manufacture. It is hoped, however, to deal with other adhesives of a special character at a later date, especially those made or capable of being made by the aid of gas.

Some Attractive Appliance Advertisements

Portland Gas & Coke Company, Portland, Ore., Runs New Series of Ads Posed from Life

By E. D. CARPENTER

The Portland Gas & Coke Company, Portland, Ore., in accordance with its policy of extensive advertising of its appliances ran recently a new series of illustrated advertisements with photographs taken from life and posed especially for the purpose.

After running a picture of the lady who posed as Mrs. Gasco, the next day's ad was a set of two pictures, the upper one reading "Which hands do you prefer? *These?* Soiled by the furnace—or *these?* The secret: Gasco furnace."

The next picture was that of the lady examining the clothes hung out to dry on the line, and instead of an "airing" they got a "sooting," and she remarks, "I must get this whole neighborhood to put in Gasco furnaces and stop all this annoyance!"

The following day the advertisement showed Mrs. Gasco looking at the soot on her window sills and addressing her husband. "Jim! look at that soot blowing in and ruining our pretty home. Why don't you get me that Gasco furnace?"

The next showed a group of houses belching smoke from their chimneys and Mrs. Gasco frowning with scorn saying, "Look at all those chimneys belching forth smoke and soot. Me for a section where they heat their homes with Gasco furnaces!"

This was followed by a photograph representing a row of clean-looking houses and a clean sky and Mrs. Gasco exclaiming, "Ah! this is more like it. No smoke, no dirt, no soot! The Gasco furnaces are indeed a boon!"

The final picture of the series showed the lady's husband and her boy peeking out from behind the curtains at the neighbor who was spending his Sunday carrying in the wood, as is customary in that city on the Pacific Coast. The picture was entitled in big type: "Don't gloat," and in smaller type added, "Now, daddy and Jimmy, don't gloat over the neighbors, because they have to spend their Sunday carrying in the wood. Remember, you were a slave, too, before I got you to put in a Gasco furnace."

It is said that Sept., 1920, was the biggest month on record for house-heating appliances; and the daily sales were recorded on the bulletin of the Pacific Coast Gas Association. The total appliance sales exceeded $68,000 with 550 Radiantfires for the month. This exceeded all previous records of the Portland, Oregon Gas Company.

Gas the Industrial Fuel of the Future

H. H. Clark, Chairman, Reports on Work of Fuel Sales Committee

The introduction of the word "sales" into the name of this committee has altered its scope considerably from that of any previous industrial fuel committee.

To increase the sale of gas seemed a hopeless task because most gas companies complained of too much business. However, it was apparent that immediate results could not be expected so we made careful plans that would produce increased sales in the near future or at such a time as the gas companies were able to take on more business, declared H. H. Clark, chairman, Industrial Fuel Sales Committee of A. G. A., in a report to be read before the coming convention at the Hotel Pennsylvania, Nov. 15 to 20.

It was evident that we had two sides to convince of the merits of gas for industrial purposes: one the gas man himself, and the other the prospective gas user.

To convince the gas man, we sent to A. G. A. headquarters photographs of successful gas installations giving sufficient data to convince the most skeptical that gas was doing the work satisfactorily and economically. Some of this information was published from time to time in the A. G. A. *Bulletin*. The remainder is in the information and data file at headquarters. The biggest argument for industrial gas is the fact that you can sell six times as much with the same investment as you can if you serve domestic customers only.

As a means of convincing both the gas man and the customer, we have prepared eighteen papers, to be presented at this meeting, on subjects of greatest possibility and interest at this time. These papers describe industrial gas uses where the price of gas is not the factor and cover such lines of business as can be put on by any gas company and are written by men who are well qualified to write on the subject. It is hoped these papers, by their convincing arguments and essential facts, will enthuse those men who are engaged in this work and also extend gas for industrial purposes into some of the smaller gas companies where it is not much in evidence at the present time.

The committee made a list of some forty important uses for industrial gas where the price of gas was not important and selected the following eighteen as most representative:

Application of Gas to—
- Internal Heating—J. F. Reynolds
- Brass Melting—A. L. Palmer
- Core Baking—R. R. Schutz
- Newspapers—W. W. Cummings
- Smoking and Curing Meats and Fish—W. T. Hudson
- Galvanizing—D. A. Flynn
- Converting Direct Fired Coal Ovens to Gas—R. V. Howes
- Steel Treating—F. F. Cauley
- Forging—Industrial Heating Department. H. L. Doherty & Co.
- Cocoa Roasting—N. T. Sellman
- Auto and Tire Repair Shops—H. L. Wolfe
- Drying—H. M. Crawford
- Educational Institutions—W. L. Powers
- Varnish Boiling—P. Dorchester
- Japanning—W. J. Hampton
- Vitreous Enameling—C. C. Krausse
- Railroad Shops—R. G. Munroe
- Asphalt Melting—C. H. Kallstedt

As a means of convincing the gas user, we have caused to be published in the various trade journals, articles on gas for industrial purposes, pertaining to the particular trade covered by the journal. We also advise industrial gas sales people to get acquainted with engineers and people in other lines of industry through local engineering societies, trade associations, manufacturing associations, bureaus of information, boards of trade, chambers of commerce and local chapters of national organizations, such as American Steel Treaters' Society, American Foundrymen's Association, etc., and encourage by publicity, personal acquaintance and other means, the use of gas

No. 3 of a series of advertisements run by the Portland Gas & Coke Company

as a fuel and the use of the American Gas Association as a service bureau on heating problems.

The committee believes that the industrial fuel sales department of any gas company should not be self-supporting, but a definite amount per thousand cubic feet of gas sold should be allowed for the expenses of the department chargeable as operating expenses under new business. All appliance sales and piping contracts by men in the industrial department should show a substantial profit, however, but no attempt should be made to have this profit pay the total expense of running the department.

We urge gas companies to co-operate with local furnace manufacturers and dealers for the purpose of having them feature gas furnaces by allowing them to make the sale if possible, because after all, the real profit to the gas company is in the sale of gas and if the gas companies make their own furnaces or convert other types or sell furnaces at a price so low that furnace dealers cannot make a fair profit, then the furnace dealers will not favor gas furnaces.

We are now at the beginning of a "gas age." The next decade will see a tremendous growth in the production of gas and the recovery of by-products. I venture to say that by the end of this decade, gas will be a by-product in the sense that we will have surplus quantities to dispose of and our efforts will be devoted to the production and sale of the various by-products derived from the carbonization of coal.

Carbonization of coal and gas as fuel are economically right in principle and are therefore sure to survive. When a pound of coal is carbonized and the gas used for fuel, this pound of coal will do the work of four pounds used to produce the same heat by direct combustion of the coal. In the first instance we recover valuable by-products necessary to the welfare of the nation. In the second case we produce soot and smoke and unconsumed gases which are a detriment to the community. The gas business is conservation in its highest degree.

Within this decade we will see houses heated by gas-fired boilers to an extent beyond our present expectations. Gas companies will prepare for this business by converting the coke from the carbonization process into gas, and this gas mixed with the original gas from the coal will have a heating value of about 400 B.t.u. per cubic foot and will be the fuel of the future. This gas will also be the fuel sold to factories.

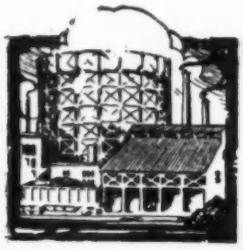
Oil as fuel for industrial purposes or as a gas-making ingredient is fast disappearing from the market. Such slogans as "plow with petroleum," "motor truck for transportation," "the automobile industry," "the airplane in commerce," "oil burning ships" are convincing arguments that liquid fuels are for mobile uses and that gas companies should be producers of liquid fuel instead of consumers. Factories will then be forced to find other fuel.

Gas as a fuel really has no competition. At times there seems to be a difference in cost when compared with oil, coal or other fuel, but when the many advantages are taken into account the possible difference in cost disappears.

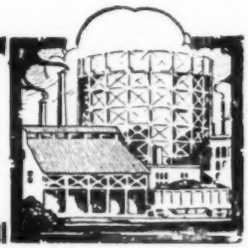
The gas company of the future will do eight times the volume of business it does to-day and the far-sighted managers will be quick to take advantage of this situation. Industrial gas is the balancing feature that will make this possible.

I wish to thank the members of my committee for their willing and able assistance during the past year and especially the sub-committee on "Furnace Performance Standards," "Improvement of Atmospheric Burners," "Proportional Mixing" and "Recuperation and Regeneration," the chairmen of which committees have prepared separate reports for your consideration.

ADVERTISEMENT No. 5 OF PORTLAND GAS SERIES



NEWS OF THE GAS INDUSTRY



Kings County Lighting Co. Wins Higher Rate Fight

The Kings County Lighting Company, Brooklyn, N. Y., has won its fight in the Federal Court for a higher gas rate. Judges Charles M. Hough in Manhattan confirmed the substantial features of the report of Special Master Gordon Auchincloss and granted an injunction restraining the authorities from enforcing the 80-cent law or the $1 law both of which were declared confiscatory.

The court did not fix a rate, but gave the company power to charge more than $1, leaving room in the judgment for any modification that might be necessary or that might be prompted by changed conditions.

Either the gas company or the Public Service Commission may make an application for revision upward or downward of the new rate that is yet to be fixed.

Under the order issued last June by the Federal Court the Kings County Lighting Company has been charging 95 cents per 1,000 cu. ft. and part of this sum has been retained in custody of the court for reimbursement in the event of a decision in favor of a lower rate. The hearings before the special master showed, Judge Hough pointed out, that it cost the company more than the rate allowed to it to make and distribute gas and that the huge demands for coal oil, creaed by the ever-increasing consumption of gasoline had made it impossible for the company to buy this vital necessity in modern-day gas production at a cost even approximating a moderate advance over the old prices.

Judge Hough held that the contention of the Public Service Commission that the gas company could resort to coking and could not be seriously considered, as the plant is not equipped for gas making by that method.

"The sum of the matter is this," declared Judge Hough. "It cost plaintiff and would have cost any other well-operated maker of gas at least 85 cents to furnish 1,000 cu. ft. of gas in 1919, and at least 96 cents to do the same thing in 1920.

"The fundamental reason for this is that the oil best fitted for the gas maker is also richest in gasoline. Therefore, plaintiff and other similarly situated manufacturers are and have been competing with, especially the motor cars. This difficulty is not temporary, so far as human foresight goes. It may well be that gas makers will be driven back to coking coal, but that does not affect the right of a concern lawfully organized to make gas with oil and possessing no plant for coal gas.

"A final decree may be submitted, which will after appropriate recitals respecting the exceptions to the master's report, confirm the report as modified, declare the unconstitutionality of the acts of 1906 and 1916 in respect to rates, award the plaintiff the injunction prayed for and costs against the appearing defendant. It will also contain the usual provisions for applying at the foot of the decree for further relief or for modification or vacation of the injunction."

The lighting company in this proceeding contended that the present cost of manufacture and distribution is $1.20 per 1,000 cu. ft. and that because it has been unable to collect an adequate rate there are no funds immediately available for the enlargement of the plant to meet the ever-growing demand of the sections it undertakes to serve.

The company claimed it was compelled to furnish gas of heating quality instead of candlepower gas. The company several years ago lost its action in the State courts for higher rates.

Des Moines Gas Company Asks $1.63 Rate

A rate of $1.63 a thousand cubic feet has been asked in a petition filed in the United States district court, by the Des Moints Gas Company, Des Moines, Iowa. The company now is collecting $1.25 a thousand. The rate fixed by the ordinance is $1.05.

Tentative Program of Second Annual Convention and Exhibition of the A. G. A.

It is peculiarly fortunate that the date of the second annual convention comes at a time when the entire gas industry is finally awakened to the necessity for continued unity of action on its many vital and perplexing problems, the proper solution of which means so much to its future prosperity.

The keynote of the November convention will be "The Gas Situation Now; Its Problem and Its Future."

We see a condition unprecedented in the history of the business, with revenues inadequate to meet the continued rising costs of labor and materials and with the industry unable to compete with other lines, under the conditions, for new capital.

We have seen our industry fully alive to the unmistakable benefits to be secured from concerted effort. As witness of this recall to mind the activities of the emergency committee and what it has accomplished in preparing the way for a better public understanding of the utilities' needs and the essential character of the service they render.

There are many activities of the association which have been well started, but we have simply scratched the surface.

We must carry on. All this leads up to what is going to take place at the convention.

The executive board invites every company and individual member to attend. Gas companies should be adequately represented not only by their executives and managers but should send their brightest young men to this convention. The meeting is not altogether for the men who know it all but for those who do not know it all and are anxious to learn. The men who must eventually direct the affairs of gas companies are the ones who need the inspiration from

and contact with trained and experienced men in the industry.

This year the holding of the exhibit on the roof garden, where ample space is available for the purpose, will provide additional space on the mezzanine floor for meetings and the social functions.

There will be 112 spaces occupied with exhibits of all the latest and improved gas appliances and apparatus, as well as office labor-saving devices and a model exhibit of modern gas-lighting units, the latter contributed by manufacturer members of the association.

The exhibition provides an opportunity for study, comparison and selection of merchandise which the gas companies will sell, and the placing of orders with the manufacturer exhibitors at that time will be appreciated by them.

The tentative program which follows has been prepared with the idea of providing discussion on many and varied topics of interest and value to both the larger and smaller companies. Advance copies of committee reports will be supplied to members on request, and all who contemplate attending are requested to familiarize themselves with the contents of the reports and come prepared to discuss them.

TENTATIVE PROGRAM

General Session

Main Ballroom, Mezzanine Floor

Tuesday, Nov. 16—Ten o'clock

Meeting called to order and Opening Remarks
George B. Cortelyou, President
Report of Membership Committee
O. H. Fogg, Secretary-Manager
Report of Secretary-Manager
O. H. Fogg, Secretary-Manager
Report of Treasurer..Wm. H. Barthold
Address of the President
George B. Cortelyou
Report of Committee on Amendments to Constitution and By-laws
W. J. Clark
Report of Nominating Committee and Election of Officers
C. H. Nettleton, Chairman
Address—The Public Utility Company in Court
William L. Ransom, New York City
Report of Committee on Time and Place, 1921 Convention

Executive Session

(Only Company Member Delegates Attending)

Election of Company Members
Election of Directors
Election of 1921 Nominating Committee
Election of Committee on Resolutions

Wednesday, Nov. 17—Ten o'clock

Address
Harry C. Spillman, New York City
Report of Emergency Committee of the A. G. A....P. H. Gadsden, Chairman
Open Discussion

Thursday, Nov. 18—Ten o'clock

Address—Post-War Tendencies as Affecting Utilities
William J. Hagenah, Chicago, Ill.
Report of General Committees
Reports of Chairmen of Sections
Report of Committee on Standard Gas Appliance Specifications
W. T. Rasch, Chairman
Report of Committee on President's Address
Open Discussion re Association Activities for the Year 1921
Closing Remarks

Accounting Section

Tuesday Afternoon, Nov. 16—Two o'clock

Report of Nominating Committee
William Schmidt, Jr., Chairman
Chairman's Introductory Remarks
A. P. Post
Report of Committee—State Representatives and Contributions to *Monthly*
J. W. Heins, Chairman
Report of Committee on Standard Classification of Accounts for Gas Corporations
W. J. Meyers, Chairman
Address—The Importance of the Accounting Department Under Commission Regulation
Rufus C. Dawes

Wednesday Afternoon, Nov. 17—Two o'clock

Paper—Purchasing and Storeroom Accounting.....L. H. Werner
Report of Committee on Merchandise Accounting..W. A. Sauer, Chairman
Report of Committee on Automobile Cost Accounting
S. J. Palmer, Chairman
Paper—Fire Insurance from the Public Utility Viewpoint.....J. G. Reese
Report of Committee on Office Labor-Saving Devices
J. L. Conover, Chairman
Paper—Restoring Office Personnel of a Public Utility Company
Paul W. Herring

Thursday Afternoon, Nov. 18—Two o'clock

Report of Committee on Uniform Accounting Nomenclature
W. H. Pettes, Chairman
Paper—Continuous Inventory of Fixed Capital .....Ernest Johnston
Report of Committee on Job Order Systems..W. G. Sterrett, Chairman
Report of Joint Committee on Trade Acceptances..L. H. Musil, Chairman
Discussion of Subjects to Be Considered by the Accounting Section in 1920-1921

Commercial Section

Tuesday, November 16—Two o'clock

Meeting Called to Order and Opening Remarks
Charles A. Munroe, Chairman
Report of Nominating Committee and Election of Officers
F. J. Rutledge, Chairman
Paper—Present and Future Outlook for Industrail Fuel Gas Sales
H. H. Clark, Chairman, Industrial Fuel Sales Committee

Followed by the presentation and discussion of the following subjects:

1. The Use of Gas in the Newspaper Plants in Boston
W. W. Cummings
2. The Use of Gas in Railroad Shops
Roy G. Monroe
3. The Use of Gas in Automobile and Tire Repair Shops...H. L. Wolfe
4. The Use of Gas in Educational Institutions.....W. L. Powers
5. The Application of Gas to Core Baking.....A. A. Schuetz
6. The Application of Gas to Drying
H. M. Crawford
7. The Application of Gas to Japanning.....W. J. Hampton
8. The Application of Gas to Galvanizing.....D. A. Flynn
9. The Application of Gas to Internal Heating.....James F. Reynolds
10. The Application of Gas to Varnish Boiling.....Paul Dorchester
11. The Application of Gas to Brass Melting.....A. L. Palmer
12. The Application of Gas to Asphalt Melting.....C. H. Kallstedt
13. The Application of Gas to Forging
H. L. Doherty & Co.
14. The Application of Gas in the Vitreous Enamel Industry
Charles C. Krausse
15. The Application of Gas to the Smoking, Curing and Preparation of Meat and Fish Products
W. T. Hudson
16. The Value of Gas for Steel Treating.....Frank F. Cauley
17. Converting Direct-Fired Coal Ovens to Gas.....R. V. Howes
18. Report of Committee on Heating
George E. Bennitt, Chairman

Sub-Committees—

Furnace Performance Standards
I. Lundgaard
Improvement of Atmospheric Burners
Jerome Brandes

Proportional Mixing....C. C. Krausse
Recuperation and Regeneration
H. O. Loebell

Wednesday, Nov. 17—Two o'clock
(Joint Session of Commercial and Publicity and Advertising Sections)
Report of Nominating Committee (Publicity Section) and Election of Officers.....William J. Clark, Chairman
Address—Keeping Oiled the Hinges on Which Big Sales Are Hung
Roy F. Soule
Address—What Real Sales Service Means..R. M. Searle, Rochester, N.Y.
Paper—Getting Results from Newspaper Publicity
John P. Lucas, Charlotte, N. C.
Report of Sales Development Committee.....William Gould, Chairman
Report of Sales Campaigns Committee
H. J. Pettengill, Jr., Chairman

Thursday, Nov. 18—Eight o'clock
Report of Committee on Compensation of Salesmen
C. M. Karshner, Chairman
Report of Committee on Filling in the Valleys in Gas and Appliance Sales
William Gould, Chairman
Report of Committee on Work Completion Schedules
G. I. Vincent, Chairman
Report of Committee on Maintenance
R. Buckminster, Chairman
Report of Committee on Gas Lighting
T. H. Piser, Chairman

TECHNICAL SECTION

Tuesday Afternoon, Nov. 16—Two o'clock
Nominating Committee
R. C. Congdon, Chairman
Introductory Remarks by Chairman of Section.....L. R. Dutton
Paper—Demand Limiting Motor
H. D. Hancock
Purification Committee—Results to Date.....C. H. Stone, Chairman
Address—The Use of Concrete at Gas Plants.....Col. H. C. Boyden

MANUFACTURING SECTION

Wednesday Afternoon, Nov. 17—Two o'clock
Development in Carbonization Methods—
Coke Division
Low Temperature Carbonization
Producers as Applied to Carbonizing Units..J. P. Haftenkamp, Chairman
Gas Works Auxiliaries
C. N. Chubb, Chairman
Refractory Materials—Particularly Referring to Water-Gas Generators
W. H. Fulweiler, Chairman
Paper—Coal Sulphur and Its Conversion in the Gas Retort
Dr. A. R. Powell
Gas Chemists' Handbook—Revised Edition.....E. C. Uhlig, Chairman

DISTRIBUTION SESSION

Status of Cast Iron Pipe Standards
Walton Forstall, Chairman
Mitigation Methods in Electrolysis
Prof. L. A. Hazeltine, Chairman
Testing, Handling and Minor Repairing of Dry Gas Meters
W. A. Castor, Chairman
Deposits in Meters
C. A. Morhous, Chairman

Thursday Afternoon, Nov. 18—Two o'clock
Gas Oil Situation to Date
W. H. Fulweiler
Waste Disposal Methods for Gas Plants.....L. J. Willien, Chairman
A Recording Gas Calorimeter
H. N. Packard
Standard Nomenclature for the Gas Industry—Progress to Date
O. E. Norman, Chairman

MANUFACTURERS' SECTION

Monday, Nov. 15—10.30 A. M.
Address of Chairman
W. Griffin Gribbell
Report of Secretary....W. W. Barnes
Report of Chairman—Membership Committee.....William M. Crane
Report of Chairman—Nominating Committee.....William M. Crane
Report of Chairman—Illustrated Lecture Committee..George S. Barrows
Report of Chairman—Division of Meter Manufacturers
Donald McDonald
Report of Chairman—Division of Gas Range Manufacturers
William M. Crane
Report of Chairman—Division of Water Heater Manufacturers
H. J. Long
Report of Chairman—Division of Office Labor-Saving Devices
H. B. Lohmeyer
Report of Chairman—Division of Heating Appliance Manufacturers
George S. Barrows
Report of Chairman—Division of Industrial Appliance Manufacturers
S. Tully Willson
Report of Chairman—Division of Lighting Appliance Manufacturers
J. P. Conroy
Report of Temporary Chairman—Division of Apparatus and Works Manufacturers.....J. S. DeHart, Jr.
Report of Temporary Chairman—Division of Supply Manufacturers
R. Mueller
Report of Temporary Chairman—Division of Accessories Manufacturers
B. Ryan
Discussion—Future Activities
Election of Officers
Installation of Officers
Adjournment

Thrift in Coal

Coal is the shortest word we have to express industrial power and domestic comfort, declared George Otis Smith, director, United States Geological Survey, Washington, D. C., in a paper read before the American Iron and Steel Institute, New York. Even the rumor of a coal shortage simply demonstrates that this fuel is in reality the staff of life to the industrial world, and the temporary stoppage of any of the larger sources of supply threatens a nation-wide crisis. Shut down our coal mines, and the country becomes not only cold but idle and hungry.

The figures of our total coal resources, millions of millions of tons, or even the few hundred million tons of our annual output, are too large to be grasped, and it becames necessary to express the facts in smaller quantities. Roughly speaking, 1,000 tons of coal is what a mine worker mines in a year—the measure of what he contributes to the world's work and well-being. This human measure of 1,000 tons also has the advantage of being easily visualized as a short train load (twenty cars) of coal on its way to serve the varied needs of the consumer, and in our brief review of the subject we may well first note what are these needs. Broadly stated, the largest use of coal is in furnishing motive power and heat for our industries and public utilities, 350 tons out of every 1,000 tons mined going to the boiler house of factory, mill, shop, or power plant. But next to these seven carloads of coal distributed throughout the country are five cars, or 250 tons of coal, which the railroads need for their own use. The domestic demand for coal comes next, 165 tons out of each 1,000 tons of anthracite and bituminous coal being used in the homes of the land for heating and cooking. The coke ovens require nearly as much as the homes, or 130 tons; and the balance of our miner's contribution includes the coal mines themselves, which of course does not make up a part of our train load; and the 10 tons that goes to the gas works.

Even in this simple analysis of the uses of coal, it would be difficult to establish any rigid scheme of priori-

ties; we absolutely need coal for each of these uses, and this nationwide dependence upon coal is so evident as to demand general attention to the subject of thrift in coal. Every citizen should do his part in making the best use of coal, but the responsibility of leadership in economy may with justice be placed upon the larger users—a priority of duty that I believe will appeal to your sense of fitness.

We are on the threshold of fuel economy. Unprecedented high prices for coal have summoned American genius to the task of getting the full value out of the half billion tons of bituminous coal we burn each year; indeed, we have been too long content simply to burn coal rather than to use it. With coal at a dollar a ton the consumer was the profiteer, and profiteerlike he thought it paid him to disregard any claims except those of his own immediate gain. Now the higher prices have opened our eyes to higher values in coal and we begin to see the possibilities of profit in avoiding waste both in the mine and in the boiler room. We do not have to recognize the claims of posterity for coal conservation, for we can see money in it for our own generation—to mine the coal that we have been leaving underground, to utilize every possible heat unit in what we burn, and especially to recover everything of value that the coal contains.

When we indorse Mr. Hoover's characterization of the bituminous coal industry as "the worst functioning industry in the country," it is with no spirit of unfriendly criticism. The simple fact must be faced that the story of coal is a story of waste, all the way from the face of the mine working to the smokestacks of the boiler plant—waste of a natural resource, waste of human endeavor, waste of capital, waste of transportation capacity, and waste of energy—and of none of these have we enough much less any to spare.

It is customary to express our coal resources in terms of tons in the ground, but how inflated such an inventory becomes when we realize that of the ton of coal "in place," where nature stored it for the use of man, the amount converted into mechanical energy, under the average practice of to-day is only 76 pounds!

The proportion of coal we leave underground is a sad commentary on our appreciation of the value of coal, and the margin between high recovery, which may be stated at 95 per cent, and the average recovery of 70 per cent or less shows to what extent we are still wasting our coal at one place alone and where the world does not see the waste. By increasing the average output of the mine worker, we have made a gain of 50 per cent in the last three decades, so that we are saving man power if not coal.

Not only is coal wasted in the mining, for no sooner does a ton reach the surface than 44 pounds of it is taken as toll for running the mine—indeed, in the anthracite mines, where often more water is raised than coal, the combined pumping, hoisting, and breaker operating cost expressed in coal has been stated as high as 200 pounds to the ton. But electrification of coal mines is gradually coming, with gratifying results in efficiency of operation and economy of fuel. In the mines of Logan County, W. Va., the saving in coal effected by supplying power from a central station has been estimated at 50 to 75 per cent, and the experience of the Lehigh Coal & Navigation Company at its Rahn Colliery is no less satisfactory. A hoisting test by this company showed that in steam practice the "stand-by" consumption of coal was nearly equal to that of the working hours. It is wholly conservative to figure that 50 per cent of coal now used in mine operation can be saved by simply extending electrification from central stations, even though this carrying of power to the mine might seem illogical.

The consumer cannot evade his share of responsibility, because of the 1,274 lb. of coal delivered at his boiler plant 548 lb. was lost in firing; he had been buying B.t.u.'s simply to throw away 40 per cent. Mr. Edwin Ludlow relates his observations at a large plant, where pride was taken in the fact that only the highest-grade coal was used, a standard of 15,000 B.t.u.'s being insisted on, but Mr. Ludlow called the attention of the company's executive officer to his boiler-room leaks, his steam results showing that he was obtaining only 11,000 B.tu..'s from this high-grade coal. That coal user needed expert firemen more than chemists—better practice rather than more theory.

Another measure of coal waste in the generation of power, even where the conditions promoting efficiency are much more favorable, is afforded by the records of the public-utility plants of Massachusetts. During the month of June last the average coal consumption in all these plants was 2.29 lb. per kilowatt hour, but at the largest plant of the largest company the average was 1.8 lb.—a saving in coal of more than 20 per cent, representing the difference between best practice and average practice.

How to save coal on a country-wide scale is the question. O. P. Hood, of the Bureau of Mines, has made the point that in a boiler plant construction, operation, and fuel are to a certain extent interchangeable. Skillful planning and careful operation can take the place of part of the coal; and on the other hand cheap coal has made possible careless firing of poorly constructed boilers without the wastefulness of the whole procedure being apparent on the books. Waste that can be seen only as a theoretical proposition does not appeal with the same force as waste that writes itself in red figures, and now that coal is no longer as cheap as dirt but has taken on the dignity that comes with high prices, we naturally begin to think of careful use. Just as we learned with foodstuffs during the war we are learning now that the higher value must be both given to coal and won from it. Thus the opportunity has arrived for the fuel engineer to teach us thrift in coal.

With all the marvelous record of industrial progress in the United States, we have good reason to ask ourselves if our knowledge isn't far ahead of our practice. As a matter of plain fact, to make great advances in coal saving it is not necessary to adopt untried theories in winning larger values from the coal we use; the first step is simply to lift average practice up to the level of the best practice. Even if the law of the survival of the fittest, under the present somewhat more humane rules of public regulation, does not to-day have full force in economic evolution, it remains of utmost importance to the world that industry should feel the pull of its most progressive units. Take, for example, the possible coal coal saving by the Massachusetts public utilities if their average efficiency should be raised not to a theoretical standard of fuel economy, but only to the standard achieved in actual practice by the largest company, which I have just cited, the result would be nearly a third of a million tons less coal needed each year by these plants—an appreciable relief in a single State, especially in a State where, as you know, it is so difficult to keep the stocks of steam fuel up to a safe level.

The use of coal in America for making coke dates back some eighty years, but the operation of by-product ovens covers only one-third of

that period, and indeed only last year did the output of by-product coke first equal that of beehive coke. The field is thus divided between the old and the new practice, but two advantages of the py-product ovens over the beehive ovens alone show how much the full substitution will mean to our country. First, the yield of coke in the by-product ovens compared with that in the beehive ovens is 23 to 25 per cent greater with the low-volatile coals and 7 to 8 per cent greater even with the high-volatile Pittsburgh coal; and second, the recovery of 7 to 15 gal. of tar, benzol, toluol, and other oils, 16 to 30 lb. of sulphate of ammonia, and the surplus gas constitutes a great resource by itself. The recent consolidation of five great chemical companies calls attention afresh to the value of these wasted constituents of coal, for not only will this consolidation go far in making America industrially independent in the matter of dyes and other coal-tar derivatives, but the new corporation, which is one of the largest units in American industry, is founded chiefly on the profitable utilization of coal smoke.

By its very name the by-product practice suggests not only saving rather than waste but the lower cost of the chief product thereby made possible. The experience of the leading producer of metallurgical by-product coke affords conclusive evidence that in the Pittsburgh district this coke can be furnished to the furnace at so much lower cost than the beehive coke as to give an ample return on the large investment required. It is very profitable to save the by-products, yet the fact must be faced that beehive ovens have been within the reach of operators who had relatively little capital, whereas a modern by-product plant on an efficient scale involves an investment of many millions. Conservation of the full value of coal is not a poor man's proposition.

The fact that more than half of the world's coal reserves are believed to lie within the territory of the United States has led too many of us into unwarranted optimism. The captains of the great industries concentrated along the Atlantic seaboard will do well to think less of the millions of millions of tons of coal that are said to lie awaiting their need in various parts of this continent-wide country of ours, but rather to ask for details as to where this coal is and how available it is for the use of this and the next generation. The total tonnage involves strings of figures hard for us to comprehend, but the tonnage remaining in the great producing fields of the East is so limited as to compel us to foresee their exhaustion within periods of the same order of magnitude as those which you executives figure as the expectancy of life for your industrial enterprises. For example, the Pittsburgh bed in Pennsylvania was estimated 40 years ago as good for 30 generations, but the rate of mining has so greatly increased that now we must measure the exhaustion of this largest bed in the Keystone State by the span of a single generation. This is not an exceptional illustration of the shortened life due to unexpected increase in drafts upon our coal resources, for in the Georges Creek field in Maryland this same bed, there called the "Big Vein," was believed 40 years ago to have a life of at least 150 years, but to-day the field is regarded as almost worked out. Even if you turn to a less nearly exhausted field, such as the Pocahontas, the earlier optimistic calculations of an expectancy of life of four or five generations are now reduced to three or even two. The lesson is that no matter how carefully the tonnage estimate of the coal reserve is made, no one seems able to estimate the rate of increase in demand in this growing country of ours. Not yet do we show any signs of slowing down in our industrial progress.

Another fact to be set down is that the best and most accessible coal is mined first, and even now we are skimming the cream from our coal resources. The truth should be stated even more plainly—we are mining much of the best coal with such disregard of the thinner beds in the same fields that we may be justly accused not only of carelessly skimming off the cream but of throwing away the skim milk beyond any possible hope of recovery. We must therefore figure on increasing costs in the future, due to greater depth and longer hauls to market. This is another reason for delaying the exhaustion of our Eastern coal fields by making full use of the coal we are now mining.

The large benefits coming in the future from this present saving of resources will be national and shared by all citizens; and likewise the public of this day and generation should share in the advantages of reduced fuel costs made possible by betterment of practice. It is well, however, to think over the old truth in the parable of the pounds, where the reward was on a sliding scale referred to the service rendered. To-day the individual or corporation who makes one ton of coal do the work formerly done by eight surely deserves a larger profit than he who uses four tions or even two tons to achieve the same result, although it is equally plain that the consumer of the manufactured product should no longer pay on the old basis of eight-ton practice. The national concern is first and chiefly in securing the largest possible coal saving, with profits therefrom, which may be divided; hence public control must never be thought of simply in terms of limitation of profits. Public commissions that have regulatory duties should first of all seek to preserve the driving force of private initiative, which renders the ever better service in the hope of proportionately larger gain. Thrift in coal, however, promises savings great enough to richly reward both producer and consumer.

Gas Stocks and Securities

The floating supply of some standard gas and other public utility stocks has been diminished by investment buying until comparatively small purchases cause flurries in those groups. People's Gas recorded an advance of 2¼ points, Consolidated Gas of 2¾ points and Pacific Gas & Electric of 1⅝ points. One factor back of the buying was the report of the Columbia Gas & Electric Company showing its total income for the year to be $9,589,869, an increase of $2,059,066, compared with that of the preceding year. The corporation's surplus amounts to $4,548,869, an increase of $1,635,792 compared with the surplus at the end of the preceding year. Public Service Commissions, with but scattered exceptions, appear disposed to grant higher rates in consideration of the advancing costs of production, and those advances in some cases are being reflected in earnings statements.

Henry L. Doherty & Co. and associated dealers are offered $5,000,000 principal amount Gas Securities Company two-year 8 per cent secured gold notes at 98 and interest, at which price these notes yield over 9 per cent. The notes are dated October 1, 1922. They are direct obligations of Gas Securities Company, a corporation which has assets of approximately $10,000,000 and are further secured by the deposit with the Trustee of 6 2/3 shares of Cities Service Company common stock for each $1,000 face value of the notes to be issued. The new notes are issued to refund a similar amount of Gas Securities Company 7 per cent secured gold notes dated Nov. 1, 1918.